3.5 Time and Frequency Domain Graphs

Time Domain and Frequency Domain Graphs

(a) The time domain graph of f is simply the plot of $f(t)$ vs. t on $[0,T]$

(b) The frequency domain graph (or frequency spectrum) of f for the value of n is the graph of the Fourier coefficients $|C_K|$ vs. frequency K/T for $K = 0, 1, \ldots n$

$$h_n(t) = \sum_{K=0}^{n} a_K \cos(K\omega t) + \sum_{K=1}^{n} b_K \sin(K\omega t)$$

$C_0 = a_0$

$C_k = \frac{a_K - ib_K}{2} \quad \therefore \quad c_K = \frac{1}{2}(a_K - ib_K)$

$C_{-K} = \bar{C_K} = \frac{a_K + ib_K}{2} \quad \therefore \quad \bar{c_K} = \frac{1}{2}(a_K + ib_K)$

$|C_{-K}| = |C_K| = \frac{1}{2}\sqrt{a_K^2 + b_K^2} \quad \therefore \quad |c_K| = \frac{1}{2}\sqrt{a_K^2 + b_K^2}$